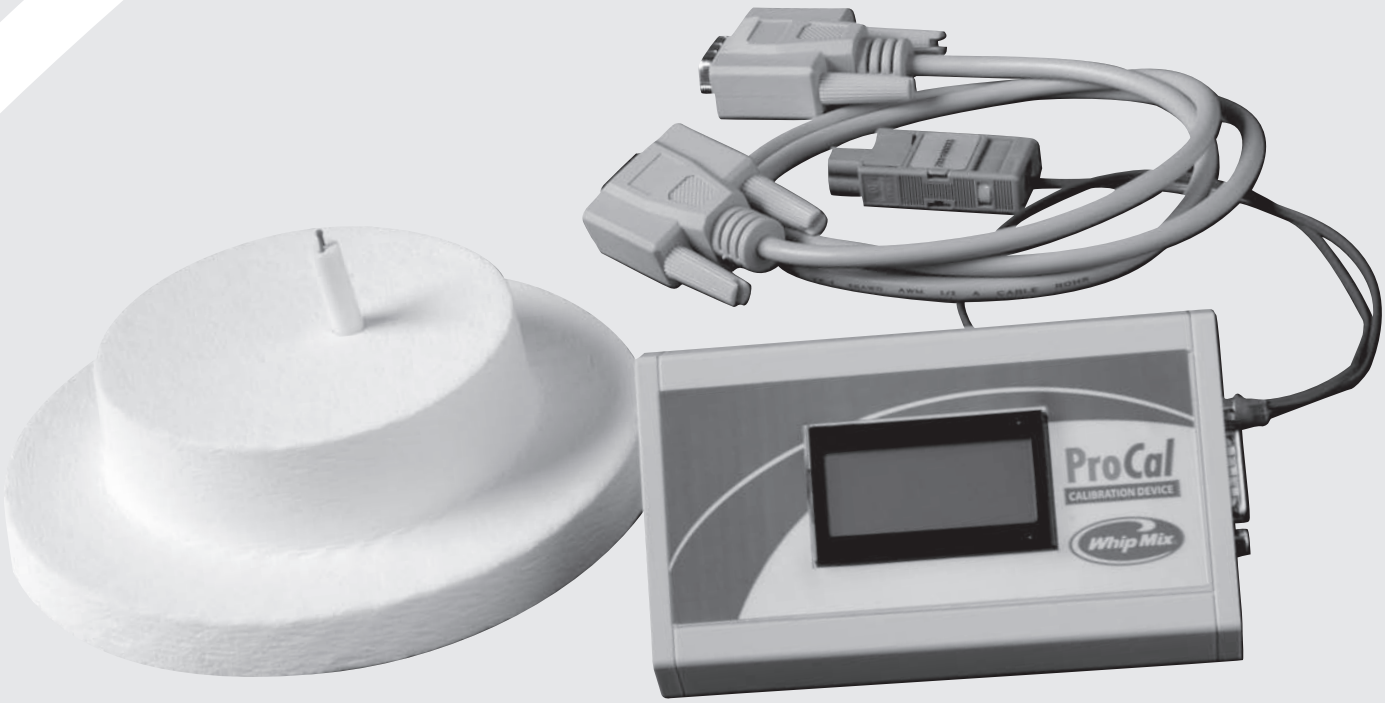
ProCal™
User Manual



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Product Overview

The Pro Cal Calibration Kit is a professional grade instrumentation system designed to rapidly monitor the calibration status of your furnace, and automatically recalibrate the furnace to factory specifications.

It is recommended that you read this manual thoroughly before using the kit as there are valuable examples of procedures and decisions you will want to be acquainted with in order to maximize the benefits you've invested in.

What You Can Do With It

QC = Quick Check (Pro 200 Series & Pro 100 Series with Adaptor #96026, Sold Separately

The Quick Check feature allows you to rapidly spot check the need for calibration. Simply place the Special Firing Tray on the Lift Table, connect the Tray to the Instrument Box and the Instrument Box to the furnace calibration port, and dial in the desired temperature you want to verify. The LCD readout on the ProCal box should agree with the furnace display to within three degrees Celsius. If not, you can choose one of several options:

1. If you check several temperatures and only one seems to be different, you can go into the firing programs which **have hold temperatures at that value** and use the **Program Level Fusing Adjust** to fine tune just those programs.
2. If you check several temperatures and **they all either overfire or underfire**, you can go into the **Special Functions** menu and select **High Fusing Adjust for temperatures over 800°C** or **Low Fusing Adjust for temperatures under 800°C** and enter the average correction value needed.
3. You can do a fully automated calibration.

Full Recalibration (Pro 200 Series Only)

The full recalibration mode requires several hours to complete, so you'll want to reserve it for times when the temperature is **more than three degrees** from nominal. Why does it take so long? To get a valid calibration which will most closely match the conditions in which it is used every day the furnace must be fully heat soaked. Secondly, the automatic calibration program requires one pass at three separate temperatures to build the calibration file. Thirdly, a second complete pass is necessary to confirm that the calibration pass is valid. This is exactly the same rigorous process that your furnace went through before it left the factory originally.

Why Do Furnaces Require Periodic Temperature Recalibration?

There are several reasons why furnaces require periodic QC checking and recalibration:

Effluents given off by the materials fired in the furnace can deposit on the platinum/palladium thermocouple and in some cases, chemically react with the noble metals, thereby affecting the temperature sensed.

Oxide layers can build up on the thermocouple through many cycles of vacuum, then exposure to air and chemically react with the noble metals in the thermocouple.

Prolonged high heat exposure can eventually crystallize the noble metals making them brittle and inhibiting the buildup of charge on each leg. The millivolts given off by a thermocouple to register temperature accumulate all along the heat exposed legs of the thermocouple, not just at the tip.

The heater wire also becomes brittle and scaly along its surface after extended usage. This can affect the infrared spectrum irradiated by the heater and redirect the angle which the photons emitted by the heater such that the ones striking the thermocouple are more diffused and therefore create less charge buildup in the thermocouple, affecting the calibration.

How It Works - What's it doing in there?

The thermocouple in the Special Firing Tray monitors the furnace activity and reports its accumulated charge back to the Instrument Box. The Instrument Box filters the electrical noise inherent with very low level signals in the microvolt to millivolt range. The cleaned-up signal is then sent to a pre-amplifier with a built in digital filter to further boost the signal and clean it up some more. Finally, the signal is presented to a 24 bit Analog to Digital Converter (ADC) for conversion into digital ones and zeros to be transmitted to the furnace computer. There is also a local "ambient" temperature sensor inside the Instrument Box which monitors the "cold junction" temperature at the point where the thermocouple alloys transition into the electronics. This cold junction temperature sensor output is automatically used by **the computer inside the Instrument Box** to correct any measurement errors as the reference signal from the Special Firing Tray makes its way back to the furnace.

Once the digital reference value from the Special Firing Tray is received back in the furnace computer its value is compared to the internal furnace thermocouple and the sign (relative over-firing or under-firing) and the magnitude of the difference are stored permanently in the furnace computer.

After the calibration process is complete, every time the furnace temperature is commanded to a specific temperature, the furnace computer looks at the target temperature, determines which calibration value is appropriate for that target value, and either adds or subtracts the stored calibration correction value in order to produce the accurate temperature desired, all in real-time.

Kit Contents

- Instrument Case
- Special Firing Tray
- Data Cable
- Operator Manual

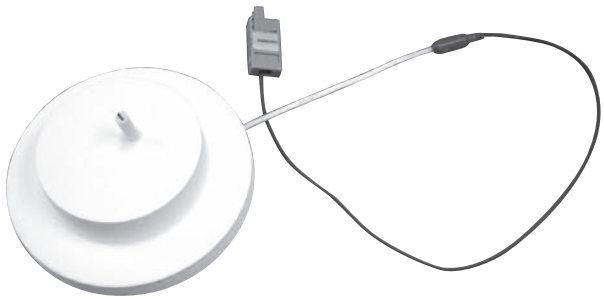
Important Notes / Reminders

The Special Firing Tray and the Instrument box form a MATCHED SET. These two components are calibrated together at the factory and the overall system accuracy depends upon these two components always being used together. If more than one Kit is on site, **never use the Special Firing Tray from one Kit with the Instrument box of another Kit or inaccurate calibrations will result.**

Since High Temperatures are present in the Furnace for extended periods of time, **it is NOT RECOMMENDED that Full Calibrations be attempted unless someone is present in the vicinity of the furnace at all times.**

Component Familiarization

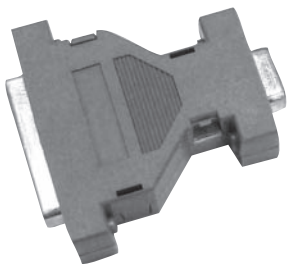
Special Firing Tray Instrument Box



Instrument Box

Data Cable

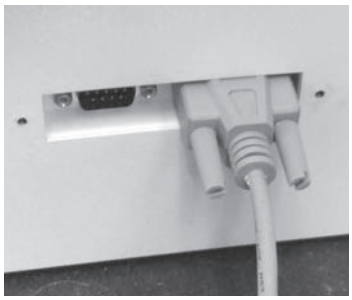
Pro 100 Series Adapter (optional)



Setup for Either Quick Check or Full Calibration

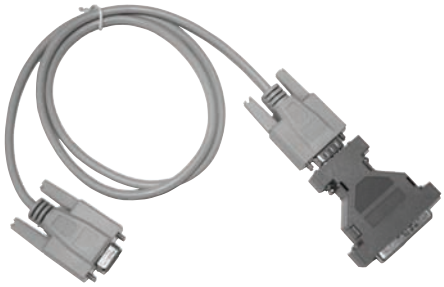
Turn the Furnace Power to the OFF position.

This is required to prevent electrical surges which could damage the sensitive electronics in the Instrument Box.



Remove the two small thumbscrews on the right side of the furnace chassis to expose the calibration ports. There are two 9-pin connectors inside the furnace which are now exposed.

Pro 100 – Connect the 25 pin to 9 pin Adaptor (#95026) to the Data Cable by mating up the 9-pin side of the Adaptor to the Data Cable, then plugging the 25 pin end into the side port of the Pro 100.



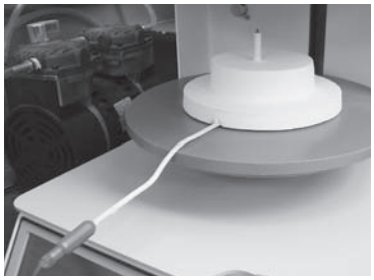
The other end of the Data Cable connects to the Instrument box in the same fashion. Once again, be sure that the connectors are fully meshed, but do not over tighten the thumbscrews.

Turn the Furnace Power to the ON position.

Wait for the furnace self-test to complete and for the Lift Table to automatically lower to the bottom position.

- **Tray Placement**

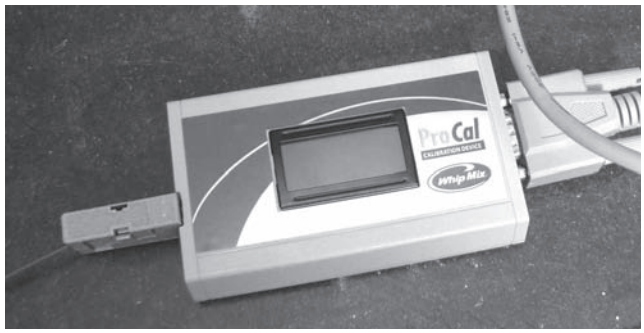
  Carefully remove the normal furnace firing tray by lifting it about an inch upward to clear the centering pin with a pair of forceps or tongs.



  Use the forceps or tongs to place the Special Firing Tray with the thermocouple embedded in it onto the tray centering pin and allow it to come to rest on the Lift Table. Swivel the Special Firing Tray so that the wire umbilical coming out of the edge of the Special Firing Tray is facing the front of the furnace.

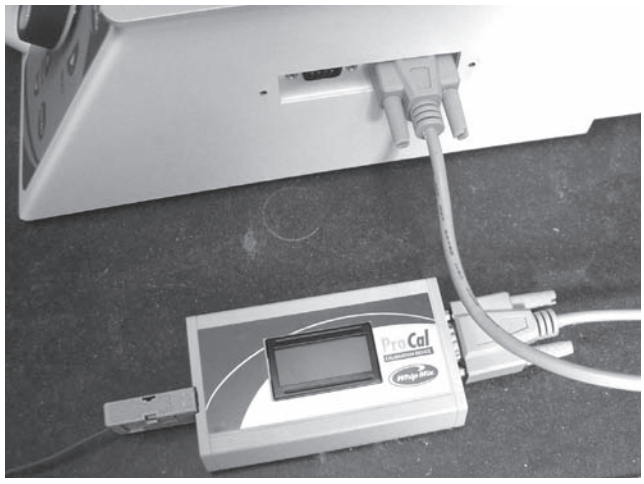
Use the Furnace **Up** Arrow button to raise the table until it is fully closed and the wire umbilical is protruding out of the front/center of the muffle.

NOTE: IT IS IMPOSSIBLE TO PULL VACUUM WITH THE SPECIAL FIRING TRAY IN PLACE BECAUSE OF THE WIRE UMBILICAL. THE CALIBRATION QUICK CHECKS AND FULL RECALIBRATION DO NOT REQUIRE VACUUM, SO THIS IS NOT AN ISSUE.



- Finally, connect the end of the Special Firing Tray umbilical into the Instrument box by inserting the green connector into the end of the Box opposite the end with the Data Cable plugged into it.

IMPORTANT: PLACE THE INSTRUMENT BOX WELL TO THE RIGHT SIDE OF THE FURNACE SUCH THAT THE BOX IS OUT OF THE PENUMBRA OR "SUNSHINE" EMITTED BY THE MUFFLE HEATER. IT NEEDS TO BE "IN THE SHADE" SO THAT THE ELECTRONICS ARE NOT AFFECTED BY DIRECT HEAT "SHINING" ON THE INSTRUMENT BOX. (EVEN IF YOU HAVE TO LET THE INSTRUMENT BOX HANG OFF THE FRONT OF THE TABLE OR COUNTER SUPPORTING THE FURNACE.)



Quick Check Survey **(Assumes the Physical Setup Step is Complete)**

Procedure for Pro 200 Series Only

Navigating to the Pro Cal Menu

From the Pro 200 **Main Menu** Select **Special Functions.**

```
Main Menu

>Special Functions
```

Scroll Through the **Special Functions** Menu Items until you reach "Calibrate Oven" and select it.

```
>Calibrate Oven
```

When prompted for a password , enter "291"

```
Password = 291
```

which will Bring up the **Pro Cal** Menu as below.

```
Pro Cal Furnace
>Quick QC Check
  Pro Cal with Preheat
  Pro Cal Only
```

Select "Quick QC Check" by pressing the **Selector Knob** OR pressing the Next button.

Entering a Temperature to Check

The Pro 200 is now ready to raise the temperature to any setting you desire and hold the temperature constant for up to 40 minutes. Select the specific temperature by rotating the **Selector Knob** clockwise for increased temperature or counterclockwise for decreased temperature. Once rotated to the desired temperature press the **Selector Knob** inward to got to the newly selected temperature.

```
Pro Cal Furnace
Change Idle Temp
>Roll Knob      250 C
Press Knob = GoTemp
```

NOTE: YOU CAN SELECT A NEW STABLE IDLE TEMPERATURE AT ANY TIME BY PRESSING THE LAST BUTTON ON THE PRO 200 ROLLING THE SELECTOR KNOB TO A NEW TEMPERATURE VALUE AND THEN PRESSING THE SELECTOR KNOB AGAIN. THE PRO 200 WILL TRANSITION TO THE NEW VALUE. YOU CAN REPEAT THIS AS MANY TIMES AS YOU WISH. IF YOU ARE DONE WITH THE PRO CAL QUICK CHECK ACTIVITY YOU CAN PRESS THE MAIN MENU BUTTON TO EXIT THE PRO CAL MODE AT ANY TIME AND THE PRO 200 WILL AUTOMATICALLY REVERT BACK TO THE PRIMARY IDLE TEMPERATURE YOU DESIGNATED WHEN YOU ORIGINALLY SETUP YOUR FURNACE FOR THE FIRST TIME.

The Pro Cal "Idle" temperature is NOT the same as the Idle Temperature you selected from the Special Functions Menu. The Pro Cal is a separate operating mode.

Allow Stabilization Time

It is suggested that a period of at least 15 – 20 minutes is allowed for stabilization time before manually recording the value on the Instrument box LCD display to insure a stable reading.

What to do with the Results

It is suggested that you survey three temperatures (minimum) to look for overall trends, and to help you decide which type of correction method best fits your available time and addresses the current situation the best.

The three primary temperatures suggested are:

Celsius Value	Fahrenheit Value
850°C	1562
1000°C	1832
1150°C	2102

These are the temperatures used by the Full Calibration method.

For example, if you surveyed the three temperatures above and when the furnace display said 850°C the LCD display on the Instrument box read 851°C.

AND at 1000°C on the furnace display the Instrument box read 1002°C.

AND at 1150°C on the furnace display the Instrument box read 1151°C.

All three being slightly higher on the Instrument box indicates that the furnace is slightly OVERFIRING across the board. Since the Over-firing values are not more than 3 degrees C above the nominal target temperatures, a Full Calibration run IS NOT INDICATED. The fastest and easiest way to proceed from here is to enter a 1 or 2 degree OVERFIRE into the **Special Functions** High Fusing Adjust section of the Pro 200 software.

The procedure for doing so follows in the next section of this manual.

One thing to remember about using the **Special Functions Menu selected Fusing Adjustment entry is it affects all User Program Firings equally, every single one of them.**

Conversely, if you had found, in the QC Survey above:

Furnace Display	Instrument Box Display
850°C	850°C
1000°C	1001°C
1150°C	1150°C

Only a single temperature range is over-firing. **You would NOT want to use the Special Functions High Fusing Adjust entry method** to register the Over-firing at the 1000°C temperature because the following would result:

Furnace Display	Instrument Box Display
850°C	849°C
1000°C	1000°C
1150°C	1149°C

As you can see from the table above, using the High Fusing Adjustment in this instance would fix the 1000°C Overfire concern, but it would also produce an undesired Under-firing situation in the ranges above (1150°C) and below (850°C).

You can still address a deviation from nominal in a single range by going into each program that has a Hold Temperature in that range and use the Program Level Fusing Adjustment.

How To Enter An Overfire Correction Using The Special Functions High Fusing Adjust

(Affects all User Firing Programs with a Hold Temperature ABOVE 800°C)

1.
```
Main Menu
  Run Program
  Change Program
>Special Functions
```

2.
```
Special Functions
  Select Language
  Cal Low Fusing
> Cal High Fusing
```

3.
```
High OverFire?
>Yes
```

4.
```
High Temp Adjustment
                    >0C

              (0C – 50C)
```

Navigate to screen #3 above. If you want to register an Over-firing correction, simply press the **Selector Knob** OR press the **Next** button. If you want to register an Under-firing correction, first roll the **Selector Knob** until the answer to the question “High Overfire?” displays “No” (meaning its not Over-firing, its Under-firing), then press the **Selector Knob** OR press the **Next** button to get to screen #4 above.

Enter the difference between what the Furnace Display said during the Quick Check and what the Instrument box Display said at the same time. Then press the **Selector Knob** OR press the **Next** button to record the correction.

Example: Lets say the furnace Target Temperature was set to 1000°C. When stabilized, the furnace Displayed 1000°C, and the Instrument Box Display shows 998°C. **The Instrument Box is always the reference point, not the furnace.** So, **the furnace is running two degrees HIGHER than the Instrument Box, in other words, the furnace is OVERFIRING by two degrees.** You would answer “Yes” to the “High Overfire?” question in screen #3 above (Yes is the default already displayed) by pressing the **Selector Knob** OR pressing the **Next** button, and then in screen #4 above you would roll the **Selector Knob** until the adjustment value “2C” displays, then press the **Selector Knob** OR press the **Next** button to record the correction.

Remember, this correction will affect all programs with Hold Temperatures above 800°C.

How to Enter An Overfire Correction Using The Program Level Fusing Adjust

Affects This One User Firing Program ONLY)

1. **Main Menu**
   Run Program
   Change Program
   >Special Functions
   — Roll Selector Knob to item, push Knob to select

2. **Special Functions**
   Select Language
   Cal Low Fusing
   > Cal High Fusing
   — Roll Knob to item, push Knob to select

3. **High OverFire?**
   >Yes
   — Roll Knob to Program #, push Knob to select

4. **High Temp Adjustment**
   >0C
   (0C – 50C)
   — Press Knob to Skip

5. **Main Menu**
   Run Program
   Change Program
   >Special Functions
   — Press Knob to Skip

6. **Special Functions**
   Select Language
   Cal Low Fusing
   > Cal High Fusing
   — Press Knob to Skip

7. **High OverFire?**
   >Yes
   — Press Knob to Skip

8. **High Temp Adjustment**
   >0C
   (0C – 50C)
   — Press Knob to Skip

9. **Main Menu**
   Run Program
   Change Program
   >Special Functions
   — Press Knob to Skip

10. **Special Functions**
    Select Language
    Cal Low Fusing
    > Cal High Fusing
    — Press Knob to Skip

11. **High OverFire?**
    >Yes
    — Roll Knob to “Yes”, then press Knob to Select.

12. **High Temp Adjustment**
    >0C
    (0C – 50C)
    — Roll Knob to “Under-fires” if desired, then press Knob to Select.

13. **Main Menu**
    Run Program
    Change Program
    >Special Functions
    — Roll Knob to set correction, then press Knob to record value

You will be returned to **Main Menu.**

Full Calibration Run

IMPORTANT NOTE: WHEN THE FULL CALIBRATION RUN FINISHES SUCCESSFULLY, THE PRO CAL SOFTWARE WILL AUTOMATICALLY ZERO OUT ANY PREVIOUSLY ENTERED HIGH FUSING ADJUSTMENTS AND LOW FUSING ADJUSTMENTS AS THE NEWLY MINTED FULL CALIBRATION CANCELS THE NEED FOR SUCH ENTRIES. THE PROGRAM LEVEL FUSING EDITS WILL, HOWEVER REMAIN IN EFFECT UNTIL USER MODIFIES THEM AGAIN.

When to Run

It is recommended that a Full Calibration Run be performed ONLY when the QC Quick Check survey indicates a deviation of over 3 degrees C between the displayed value on the furnace display and the displayed value on the Instrument Box display.

To Preheat or Not

It is recommended that the Preheat version of the Full Calibration Run be used for best accuracy. The difference in Run Time is 27% but even the shorter version requires 2:15 hours versus the cool muffle version Run Time of 4:25 hours.

How to Launch the Calibration Run

See the Physical Setup Section Described Previously to configure the Kit for a Run, then:

From the Pro 200 **Main Menu** Select **Special Functions.**

```
Main Menu

>Special Functions
```

Scroll Through the **Special Functions** Menu Items until you reach “Calibrate Furnace” and select it.

```
>Calibrate Furnace
```

When prompted for a password , enter “291” which will Bring up the **Pro Cal** Menu as below.

```
Password = 291
```

Scroll down to the Pro Cal with Cool Muffle Selection as shown below and press the **Selector Knob**.

```
Pro Cal Furnace
  Quick QC Check
>Pro Cal – Cool Muffle
  Pro Cal – Soaked Muffle
```

How to Keep Tabs on the Calibration Run

The sample displays below will keep you informed of the run’s progress

COOL MUFFLE TIMELINE

```
Pro Cal Furnace
  Quick QC Check
>Pro Cal – Cool Muffle
  Pro Cal – Soaked Muffle
```

```
Pro Cal Furnace

  Connect
  Instrument Box
```

```
Pro Cal Furnace
  Initial Check
        4:25:00
```

```
Pro Cal Furnace
  Preheat 400 C
        4:15:00
```

```
Pro Cal Furnace
  Preheat 600 C
        3:15:00
```

```
Pro Cal Furnace
  Preheat 975 C
        2:15:00
```

```
Pro Cal Furnace
  Open Cool
        2:05:00
```

```
Pro Cal Furnace
  Heat 600 C
        1:50:00
```

```
Pro Cal Furnace
  Calibration 850 C
        1:35:00
```

```
Pro Cal Furnace
  Calibration 1000 C
        1:20:00
```

```
Pro Cal Furnace
  Calibration 1150 C
        1:05:00
```

```
Pro Cal Furnace
  Open Cool
        0:50:00
```

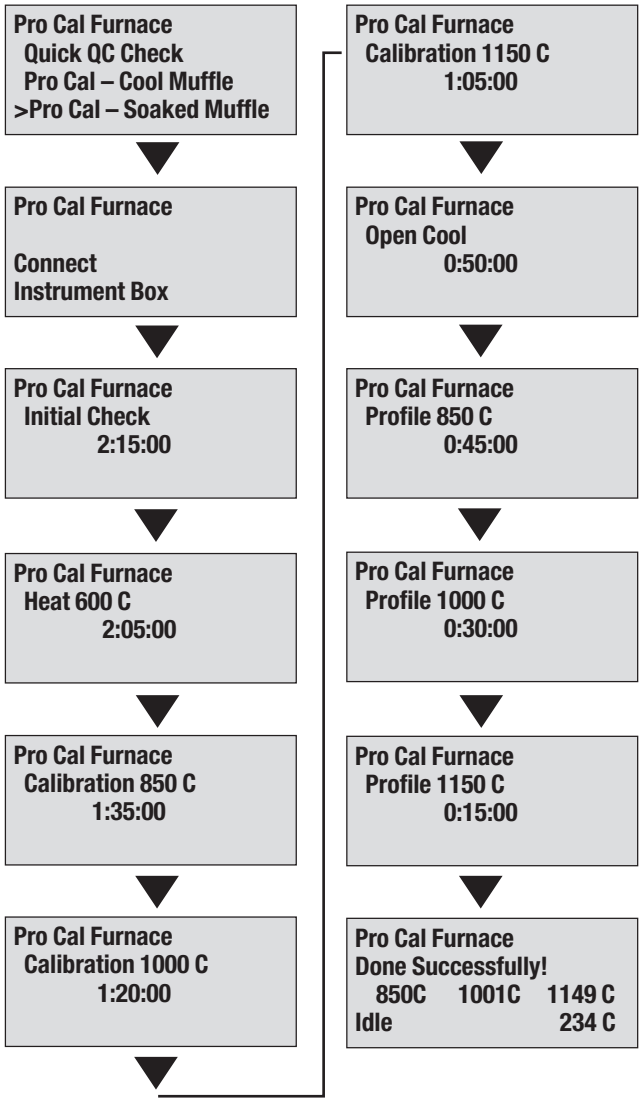
```
Pro Cal Furnace
  Profile 850 C
        0:45:00
```

```
Pro Cal Furnace
  Profile 1000 C
        0:30:00
```

```
Pro Cal Furnace
  Profile 1150 C
        0:15:00
```

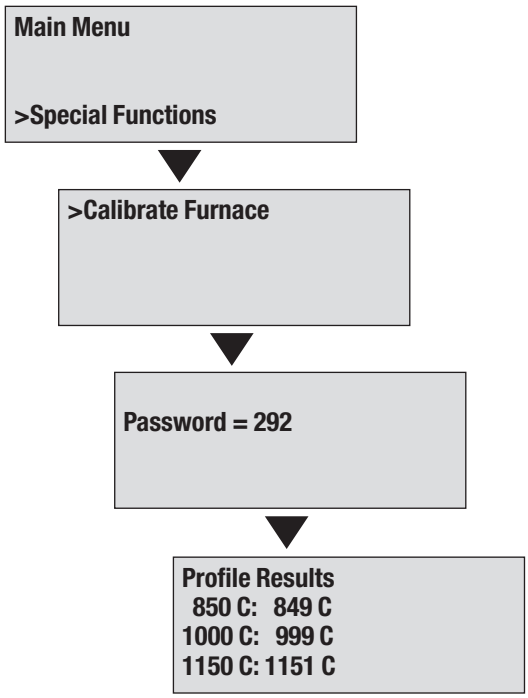
```
Pro Cal Furnace
Done Successfully!
  850C    1001C    1149 C
Idle                234 C
```

SOAKED MUFFLE TIMELINE



Inspecting the Results

- **Within 40 Minutes of Completion**
  The three calibration results for 850°C, 1000°C, and 1150°C are on the confirmation screen shown above.
- **Anytime Thereafter** you can retrieve the information by doing the following:



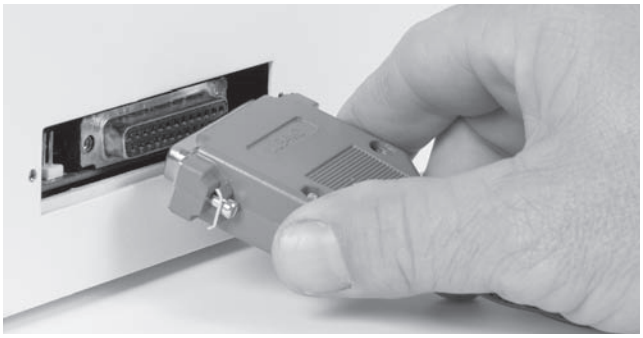
Detailed Directions for Use with the Pro 100 Series Furnaces

IMPORTANT: THE FURNACE AND THE PROCAL KIT FIRING TRAY MUST BE HEAT SOAKED AT >=600ºC FOR AT LEAST AN HOUR TO GET CONSISTENT, REPEATABLE RESULTS.

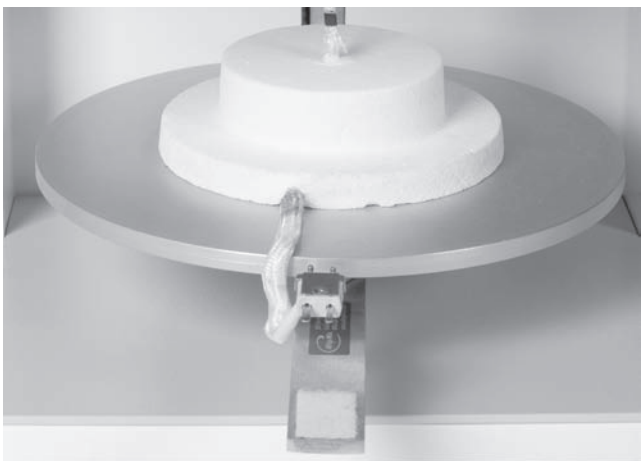
Section A — Routine Quality

Control Checking

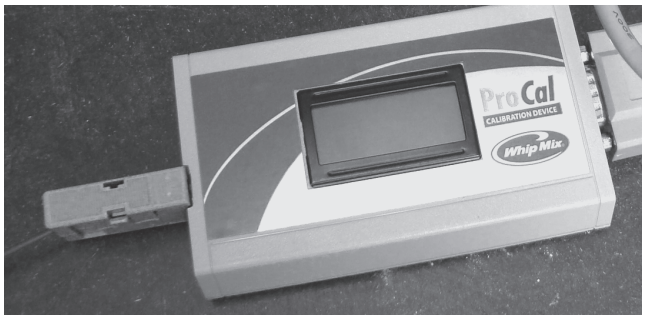
1. Remove the two thumbscrews on the right side of the furnace chassis, exposing the 25 pin connector.
2. **Turn off the AC Line power to the furnace before inserting the 25 pin adaptor then plug the 9 pin ProCal cable into the adaptor.** After the connector is seated, turn the AC Line power back on the furnace.



3. The table will drop automatically after the Power On Self Test has completed. Place firing tray on table after using centering pin to locate its position.



4. Raise table to close muffle. Allow the white cable to exit out the front of the muffle.
5. Connect instrument box to the green thermocouple connector, noting it will only plug in one way.



6. Press **SPECIAL FUNCTIONS** button on Pro 100 Furnace.

7. Rotate counter clockwise to **CALIBRATE OVEN.**

8. Enter PASSWORD = 250, then press **NEXT** button.

9. Enter the same **IDLE TEMPERATURE** as the **TARGET QC** temperature, **don't forget to press the NEXT button on the furnace to enter your idle temp selection.**

10. **Important, wait for furnace to stabilize at selected value for 15-20 minutes before passing judgement on furnace calibration.**

11. After the stabilization time record the "actual temp" on the furnace display and the temperature on the ProCal display on a piece of paper.

    *** The ProCal is more stable than virtually any furnace it is present in. All furnaces turn the heater on until the target temperature is reached then switches it off and coasts downward until the thermocouple senses the temperature is just below the target, then repeats the cycle. This means there will be a slight oscillation of temperature a degree or two above the target and a degree or two below the target;

12. If the ProCal display value is higher than the furnace display the furnace is overfiring.

    EXAMPLE: Idle temp 850°C
    Furnace actual temp=850°C
    ProCal display remp=855°C

    The furnace is overfiring by 5°C at this temperature.

13. Repeat above procedure at 1000°C idle and again at 1150°C idle setting.

    Example of results:

	Furnace	ProCal
850°C	850°C	855°C
1000°C	1000°C	1003°C
1150°C	1150°C	1152°C

14. Since all 3 QC checks show readings higher on the ProCal than on the furnace the furnace is overfiring. Use the 'high fusing' adjust feature to dial in compensation.

    Since the high fusing adjust affects all programs over 800°C equally you may want to use a high fusing Adjustment valve of 3 degrees. (See section B to find procedure on entering high fusing adjustments.)

Important Note

The Fusing Adjustment function will render correction **in the normal User Program firing mode ONLY**. If you've got active Fusing Adjustments from previous QC Checks they will not correct the **Special Functions** \ Calibrate Oven \ Password = 250 \ Idle temperatures. **You ALWAYS get the temperature based on the most recent factory calibration in the Password = 250 mode.**

OK, what does that mean?

Here is an example:
You noted a 2 degree Overfire on a previous QC check and entered a 2 degree Overfire into the High Fusing Adjustment and all has been well for the last few months. Today you ran your next QC Check and this time you note a 3 degree Overfire situation in the Password = 250 mode. [Remember, the Password = 250 mode always references back to the factory calibration] You go to the Calibration – High Fusing adjustment, answer **YES** for overfire, but do you enter 2 degrees from the first correction plus 3 degrees from today's QC check?

THE ANSWER IS DEFINITELY NO! If the needed correction in the current QC check indicates a 3 degree Overfire, just enter the 3 degrees and press the Next button. **The corrections are not cumulative.** Every time you press the **Next button the furnace first erases all previously stored correction values, it effectively restores the factory calibration for that temperature.** In other words it always wipes the slate clean, so any correction value you determine is needed during QC Checks in the Password = 250 mode is exactly the value you should enter in the Calibration - High Fusing mode.

Interpretation of Results

Consistency is more important than absolute accuracy for pure porcelain work. Notable exceptions to this are the CapTek process which depends on absolute accuracy for optimum infiltration. Once you have a furnace **setup and programmed to your liking, this is the BEST TIME to run a QC check as described in Section A to serve as a benchmark reference in case something goes astray in the future.**

The primary advantage of the ProCal is the ability to register temperature calibration data AFTER a problem has crept into the overall build-up and firing process, and immediately tell you whether the problem is with the porcelain mixture itself, the furnace, or a combination of both. **You can only have confidence in the data obtained from the ProCal if you routinely and regularly get consistent indications to base that confidence on.** Another way the ProCal can benefit you is by providing comparison data on all your Pro Series furnaces to ensure that every Pro Series furnace matches the results from all others with matched program parameters.

Section B — High Fusing Adjustments

Calibration – High Fusing Adjustment

Both the Password = 250 Idle temperature AND the High and Low Fusing Adjustments always reference back to the stored Factory Calibration point, not the previously stored adjustment.

What this means is that when you set the Idle Temperature in the Password = 250 mode to an Idle temperature of 850ºC the furnace takes the muffle to the temperature corresponding to the value it saw when it was calibrated at 850ºC at the factory.

Lets say that the ProCal reads 855ºC when furnace reads 850, a 5 degree overfire (relative to the last factory calibration point).

You need to go into the **Special Functions** \ Calibration - High Fusing Temperature Fusing adjustment and dial in an offset which will result in User Programs firing 5 degrees lower at 850ºC.

1. You would press **Special Functions**, rotate the knob to **Calibration–High Fusing**, and press the **Next** button.

Press **Special Functions** Button

Rotate Knob to “Cal – High Fusing”, Press **Next** The furnace would display “**High Fusing – Overfires?**” on the top line and **Yes** or **No** on the second line.

If we answer yes, we can input an Overfire value, if we answer **No**, we're actually saying that the furnace was Underfiring, not Overfiring.

2. In this example we were Overfiring by 5 degrees, so we answer **Yes** and press **Next** button.

3. The furnace will now display the last known Overfiring fusing adjust entry value; it might be 0, it might be 50, **IT DOES NOT MATTER WHAT IT SAYS. THE ONLY THING THAT IS IMPORTANT IS THE AMOUNT OF OVERFIRING YOU HAVE RIGHT NOW.**

   Spin the dial to the desired value of 5 degrees of Overfire adjustment and press **Next** button. As soon as you press the **Next** button the CURRENT fusing offset value is stored to non-volatile memory (after erasing all previous values, either Overfire or Underfire).

   If you are curious about what was previously stored you can go into the Fusing Adjust mode, inspect the stored value and back out without altering the value by pressing the **Special Functions** button [not the **Next** button].

4. The next time you run a normal firing program with a hold temperature above 800ºC the furnace will automatically deduct 5 degrees from the programmed hold temperature and the actual temperature will be accurate.

Appendix – Special Functions Mode Menu Selections

When you press the **Special Functions** button the first menu selections appear at the top below. As you rotate the knob Clockwise, the sequence of selections is shown below, from top to bottom:

Special Functions Menu

1. Night Mode
2. Change Idle Temp
3. Set Vacuum Level
4. Temp in C or F?
5. Prog Start Delay
6. Night Mode Temperature
7. Constant vc Pump
8. Sp Cool Position
9. Capital Letters?
10. Porcelain Names:
11. Cal Low Fusing
12. **Cal High Fusing**
    High Overfires (Yes/No)?
    Overfires – confirm Yes with Next button, enter amount, press Next button.
    Underfires – rotate knob to No, confirm with Next button, enter amount, press Next button.
13. Print Form
14. Set Time & Date
15. Programs > Box
16. Programs > Box
17. Test Furnace
18. **Calibrate Oven**
    Password – [rotate knob to 250], press Next button
    Change Idle Temp
    New Idle - xxx [enter temperature, press Next button]
    Last button gives chance to change temperature again, press Next after.

Troubleshooting

- Possible Error Conditions & What to Do

Error Number Displayed	Problem	What to Do About It
100	Pro Cal reading exceeds upper limit	This could be a bad furnace thermocouple, causing the furnace temperature to go very high. Remove the Pro Cal Kit and verify the furnace Actual Temperature is tracking the furnace Target Temperature. If the furnace itself is not the issue, contact Whip Mix Customer Service.
102	The difference between the furnace temperature reading and the Pro Cal temperature reading is too great.	Make sure the Pro Cal tray is inside the furnace, and check the cable connections between the tray and the Device Box and the Device Box to the furnace connectors are seated tightly. Restart the Pro Cal cycle, if error persists, contact Whip Mix Customer Service.
103	Cannot read temperature from Device Box.	Make sure the Pro Cal tray is inside the furnace, and check the cable connections between the tray and the Device Box and the Device Box to the furnace connectors are seated tightly. Turn the furnace main power off, leave it off for ten seconds then turn it back on and restart the Pro Cal cycle, if error persists, contact Whip Mix Customer Service.
104	Cannot sense temperature rising on Pro Cal Tray (but electronic communications are good)	This most likely means the Pro Cal Kit is connected correctly, but the Pro Cal tray is not physically on the furnace lfit table. Verify Pro Cal Tray is inside furnace muffle. If error persists, contact Whip Mix Customer Service.
105	High Ambient Temperature Reading	The Pro Cal Device Box contains an “ambient temperature sensor” which monitors the internal temperature of the Device Box itself. If the reading is too high it can affect the accuracy of the Calibration. Move the Device Box away from the furnace so that it is not exposed to elevated heat from either the furnace being calibrated or another nearby furnace.
106	Unstable temperature readings.	The primary cause would be an intermittent electrical connection between the Tray and the Device Box or between the Device Box and the furnace. Re-seat all connections and re-launch the calibration. Turn the furnace main power off, leave it off for ten seconds then turn it back on and restart the Pro Cal cycle, if error persists, contact Whip Mix Customer Service.
107	No Ambient Temperature Reading	(See also Error 105 above) This is most probably an electronic fault inside the Device Box and would render inaccurate calibrations if not addressed. Turn the furnace main power off, leave it off for ten seconds then turn it back on and restart the Pro Cal cycle, if error persists, contact Whip Mix Customer Service.

Troubleshooting

The following three Error Codes 108, 109 and 110 have multiple possibilities.

First, verify all the Pro Cal Kit electrical connections are tightly connected, especially if Error 108 is displayed (the first temperature to be checked). Re-start the Pro Cal cycle afterwards.

Second, if the furnace has been idle for a while or at low heat with the Lift Table open, moisture may have accumulated in the white muffle insulation. Pre-soak the muffle at high heat for 30 minutes to an hour (you can use the Quick Check Selection on the Pro Cal Menu and enter 850 – 1000°C as a target temperature), then re-start the Pro Cal cycle afterwords.

Third, use the Quick Check mode and set an 850°C Target Temperature and wait for the furnace Actual Temperature to rise to 850°C. Observe the Actual Temperature for a couple of minutes and if the Actual Temperature on the furnace display is not stable at 850°C, there is a significant problem in the furnace itself which will require attention. Consult Whip Mix Customer Service in this instance.

Error Number Displayed	Problem	What to Do About It
108	Pro Cal Temperature Check failed at 850°C	See above.
109	Pro Cal Temperature Check failed at 1000°C.	See above
110	Pro Cal Temperature Check failed at 1150°C.	See above

These are two additional Error Codes.

Error Number Displayed	Problem	What to Do About It
111	Communication Error	The furnace cannot communicate with the Pro Cal Device Box electronically. Check the connections at both the furnace and the Device Box. (Possible defective cable.) Turn the furnace main power off, leave it off for ten seconds then turn it back on and restart the Pro Cal cycle, if error persists, contact Whip Mix Customer Service.
112	Unreliable temperature data readings.	Basically the same as Error 106. Turn the furnace main power off, leave it off for ten seconds then turn it back on and restart the Pro Cal cycle, if error persists, contact Whip Mix Customer Service.

Technical Support

For additional support please contact us at (800)626-5651.

Specifications

- Special Firing Tray – Type K Thermocouple with ceramic support, ceramic fiber sheath in hot zone.

  Maximum Temperature: 1200 Degrees Celcius.

- Instrument Box – ABS plastic enclosure with 2 line by 8 character LCD Display.

  Maximum Temperature: 125 Degrees F

  Power: +5 VDC +/- .1% @ .030 Amps, furnished by Furnace under test via Data Cable.

  Fuse: None (draws power from furnace under test)

- Data Cable – 9 pin DSub Male/ 9 Pin DSub Female, shielded. Standard RS232 Computer Cable.

  Maximum Temperature: 125 Degrees F.

- System Accuracy: +/- 0.125% of measured temperature.

- Calibration Results Accuracy: +/- 3 degrees Celsius from 700°C to 1200°C.

- Pollution Category: 1

- For Indoor Use Only

- Environmental Ratings:

  Altitude: Up to 2,000 meters

  Ambient Temperature: 5°C – 40°C

  Relative Humidity: 80% @ 31°C
  linearly decreasing to 50% @ 40°C

- Duty Cycle: 100%

- Dimensions: Case – 14.0", (355 mm) Width
  14.5", (369 mm) Length
  5.0", (127 mm) Depth

- Shipping Weight: 3.86 LB, (1.75 Kg)